



Original Article

Retrospective study to evaluate the treatment of digital pulp lesions using a homodigital flap[☆]



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ABSTRACT

Objective: To assess the homodigital flap surgical procedure, as well as the function of the finger, pain, sensation, esthetics, and patient satisfaction.

Method: Retrospective analysis of records and questionnaires of patients who underwent this surgical technique between the months of May 2013 and October 2016. Eight were included in the study, with an average follow-up period of 23 months. Patients with digital pulp lesions of the thumbs and those who did not perform rehabilitation were excluded. All underwent the two-point discrimination test, the Semmes–Weinstein test, and range of motion evaluation. The age varied from 22 to 59 years (average of 32.9), six (75%) being male patients.

Results: Three patients (37.5%) had involvement of the right hand and five of the left (62.5%). Regarding the etiology, seven suffered injury and one a chemical burn. The average distance obtained from the two-point discrimination test was 7.3 mm. All patients who underwent the Semmes–Weinstein test obtained response to the purple filament. The average sum of the range of motion of the affected digit was 98.9%. The flap area was on average 294.4 mm². The return to work averaged seven weeks. A positive Tinel sign was found in the donating area and two reported intolerance to cold. Partial or total necrosis of the flap was not observed.

Conclusion: The homodigital flap technique presented satisfactory esthetics and functional results regarding feasibility, sensation, and digital mobility in pulp lesions.

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Estudo retrospectivo para avaliação do tratamento de lesões da polpa digital com retalho homodigital

R E S U M O

Palavras-chave:

Dedos/cirurgia

Amputação traumática

Retalhos cirúrgicos

Objetivo: Avaliar o procedimento cirúrgico de retalho homodigital, bem como a função do quirodáctilo, a dor, a sensibilidade, a estética e a satisfação do paciente.

Método: Análise retrospectiva de prontuários e questionários de pacientes submetidos a essa técnica entre maio de 2013 e outubro de 2016. Oito pacientes foram incluídos no estudo, com uma média de seguimento de 23 meses. Foram excluídos os pacientes com lesões de polpa digital em polegares e os que não fizeram reabilitação. Todos os pacientes fizeram os testes de discriminação entre dois pontos, Semmes-Weinstein, e avaliação do arco de movimento. A idade variou entre 22 e 59 anos (média de 32,9), seis (75%) eram do sexo masculino.

Resultados: Três pacientes (37,5%) tiveram acometimento da mão direita e cinco (62,5%), da esquerda. Com relação à etiologia, sete sofreram lesão traumática e um sofreu queimadura química. A distância média obtida no teste de discriminação entre dois pontos foi de 7,3 mm. Todos os pacientes submetidos ao teste Semmes-Weinstein obtiveram resposta ao filamento de cor roxa. A média da somatória do arco de movimento do dígito acometido foi de 98,9%. A área do retalho foi em média de 294,4 mm². O retorno ao trabalho foi em torno de sete semanas. Um apresentou sinal de Tinel positivo na área doadora e dois referiram intolerância ao frio. Não se observou necrose parcial ou total do retalho.

Conclusão: : A técnica do retalho homodigital apresentou resultados estéticos e funcionais satisfatórios quanto à viabilidade, sensibilidade e mobilidade digital em lesões da polpa.

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Introduction

Digital pulp lesions are common in Brazil. Finger crushing and laceration caused by crushing by a door or between two objects, whether in the residence or in the workplace, are the most prevalent types. Patients are mostly pre-adolescent children or young adults. The third finger is the most often injured, due to its greater exposure when compared to the others.¹⁻³

Several techniques have been described for the initial emergency treatment of fingertip injuries, such as amputation, primary closure, grafts, and flaps.²⁻⁸

Digital pulp lesions are complex, and the preservation of a painless range of motion, sensation, and esthetics are challenging. Adequate rehabilitation is necessary to avoid joint stiffness and contracture.^{3,7-10}

The homodigital flap is a procedure that uses one of the digital arteries of the injured finger. It was first described by Kojima et al.¹⁰ and has the advantage of confining the reconstruction to the finger itself, which allows for a faster recovery, without the need for immobilization of the few fingers. It is of great value in digital pulp lesions, with few complications and good esthetic and functional results.^{1,5-10}

This study is aimed at evaluating the surgical procedure of the homodigital flap regarding esthetics, finger function, pain, sensation, and satisfaction of the patients who underwent this surgical treatment.

Methods

The study was approved by the Research Ethics Committee of the institution under opinion No. 1713113 Plataforma Brasil – CAE 58910916.4.0000.5442.

The study was carried out with data from medical records and questionnaires answered by patients from May 2013 to October 2016, aiming to evaluate the homodigital flap surgical procedure, finger function, pain, sensation, and satisfaction of those who underwent this surgical treatment.

The data was collected from the Center of Hand Surgery and Microsurgery of the hospital in which the authors work; the images of the clinical cases presented here, which refer to the surgical technique, originated from the authors' private files.

Fifteen medical records of patients with digital pulp lesions were selected; of these, eight met the inclusion criteria.

Patients with digital pulp lesion or amputations who underwent homodigital flap surgery and remained in outpatient follow-up at the hand surgery clinic and in occupational therapy (OT) were included.

Patients with digital pulp lesions of the thumbs or those who did not perform the rehabilitation protocol with OT were excluded.

These medical records were reviewed between September and October 2016.

Table 1 – Distribution by finger.

Finger	n	%	p-Value
Finger 3	6	75%	Ref.
Finger 4	1	12.5%	0.012
Finger 5	1	12.5%	0.012

The following data were collected: age, gender, side, etiology, and affected finger. The main etiology was trauma in seven patients (87.5%), and one patient presented a chemical injury (12.5%; $p = 0.003$). Table 1 presents the fingers involved.

The postoperative protocol consisted of simple dressing with rayon, antibiotic prophylaxis, and anti-inflammatory and analgesic drugs. Patients were instructed to elevate the operated limb and mobilize the other fingers and wrist.

During the outpatient follow-up, patients were asked about the presence of pain, cold intolerance, and possible limitations of daily activities.

The surgical wound was evaluated one week postoperatively, and for reassessment and suture removal at two weeks.

Between six and 23 months postoperatively, patients were followed-up to assess fine sensation in the flap area, using the two-point discrimination test (Weber test) and the Semmes–Weinstein monofilament test¹¹; in the latter, the entire group presented purple color result, i.e., decreased hand

sensation, enough to prevent lesions, but difficulty in discriminating shape and temperature (Table 2).¹¹

A goniometer was used to calculate the sum of the active range of motion of the proximal and distal metacarpophalangeal and interphalangeal joints.








For surgery, patients were placed in dorsal recumbent position under general anesthesia. A Mayo table was used to support the limb to be operated; asepsis and antisepsis were performed, and a pneumatic tourniquet was placed at a pressure of 250 mmHg.

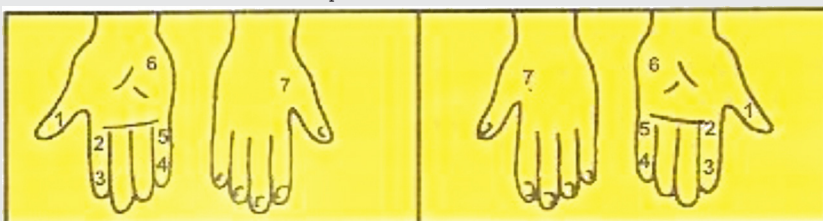
After inspecting the lesion, the affected finger was debrided and cleansed; the lesion was also measured, in millimeters, using a sterile ruler.

The flap was designed based on the lesion measurements on the homolateral side of the proximal phalanx of the affected finger, with the neurovascular bundle as the central axis between the flexion folds of the proximal metacarpophalangeal and proximal interphalangeal joints, 2 mm from the interdigital fold. The incision was extended distally using the Brunner technique.^{4,5}

The flap was separated from the sheath of the flexor tendons, in a proximal to distal direction. The neurovascular bundle was dissected; a 4× magnifying glass was used, and the fatty tissue was kept around it to avoid damage. The digital nerve was sectioned at the proximal border of the flap. The rotation point of the pedicle was located 5 mm proximal to

Table 2 – Semmes–Weinstein monofilament test.¹¹

The first response is to the color filament	Interpretation	Code for mapping	
Green (nominal: 0.05 g)	“Normal” sensation for foot and hand	Green disk	
Blue (nominal: 0.2 g)	Decreased sensation of the hand, with difficulty in fine discrimination (within “normal” for the foot)	Blue disk	
Purple (nominal: 2.0 g)	Decreased protective sensation of the hand, sufficient to prevent injury. Difficulties in discriminating shape and temperature	Purple disk	
Dark red (nominal: 4.0 g)	Loss of protective sensation of the hand and sometimes of the foot. Vulnerable to injury. Loss of hot/cold differentiation	Red disk	
Orange (nominal: 10.0 g)	Loss of protective sensation of the foot, can still feel deep pressure and pain	Red circle with an “X”	
Magenta Red (nominal: 300 g)	Sensation to deep pressure, patient may still feel pain	Red circle	
None	Loss of sensation to deep pressure, patient usually cannot feel pain	Black disk	



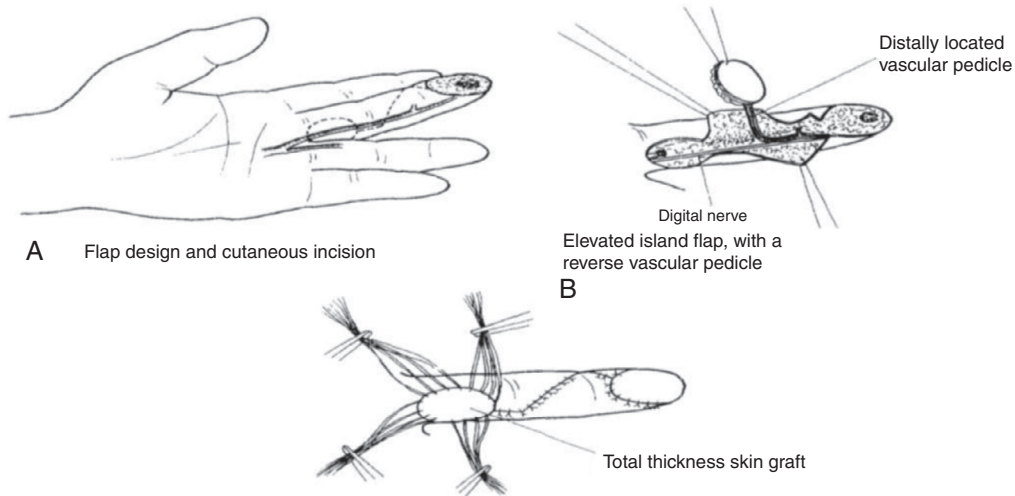


Fig. 1 – Surgical technique.¹⁰

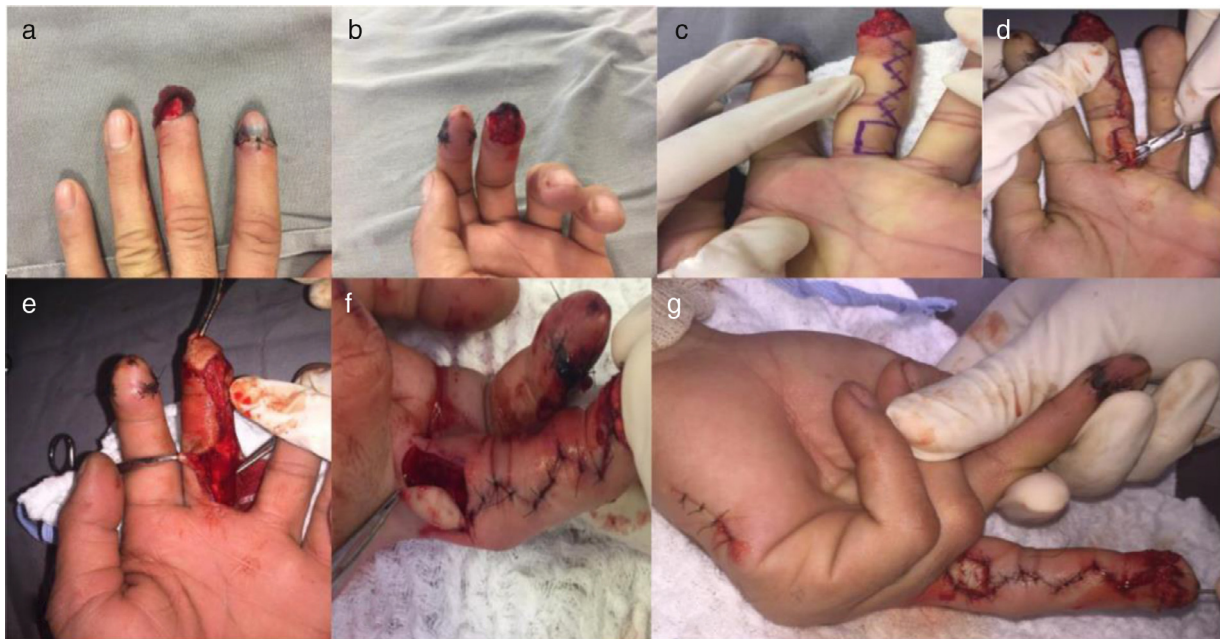


Fig. 2 – 1st surgical case – male, 23 years, traumatic injury of the third left finger, surgical technique: (a) preoperative lesion, dorsal view; (b) preoperative lesion, volar view; (c) flap design; (d) exposure of the vascular pedicle; (e) flap rotation; (f) graft in donor area; (g) final aspect.

Source: Surgical technique teaching files by Dr. Marcelo Tavares de Oliveira – Master and PhD in Hand Surgery – Unifesp.

the distal interphalangeal joint, oriented by the reverse flow of the digital artery through the communicating branches of the contralateral artery (Fig. 1).¹⁰

The flap was transposed and sutured in the recipient area. In these cases, it was decided not to perform neuroorrhaphy with the contralateral nerve. The secondary defect, created in the donor area, was closed primarily or covered with a skin graft removed from the hypothenar region. The tourniquet was released and perfusion was observed (Figs. 1-6).

Results

For the statistical analysis of the results, the following softwares were used: SPSS version 17, Minitab 16, and Microsoft Excel 2010.

The third finger was affected in six patients (75%); the fourth, in one (12.5%); and the fifth, in one (12.5%; Table 1).

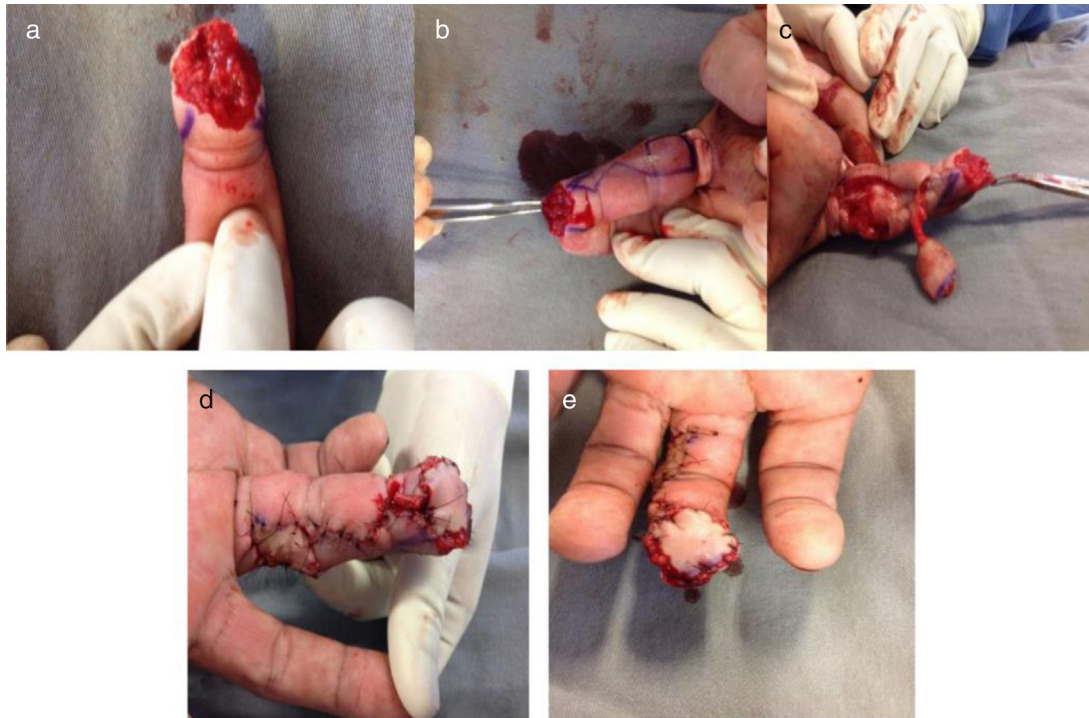


Fig. 3 – 2nd surgical case – male, 34 years, traumatic injury of the third left finger, intraoperative. Digital pulp volar lesion (a). Flap design (b). Flap with pedicle (c). Final appearance, donor area graft and flap rotation (d). Final volar appearance (e). Source: Surgical technique teaching files by Dr. Marcelo Tavares de Oliveira – Master and PhD in Hand Surgery – Unifesp.

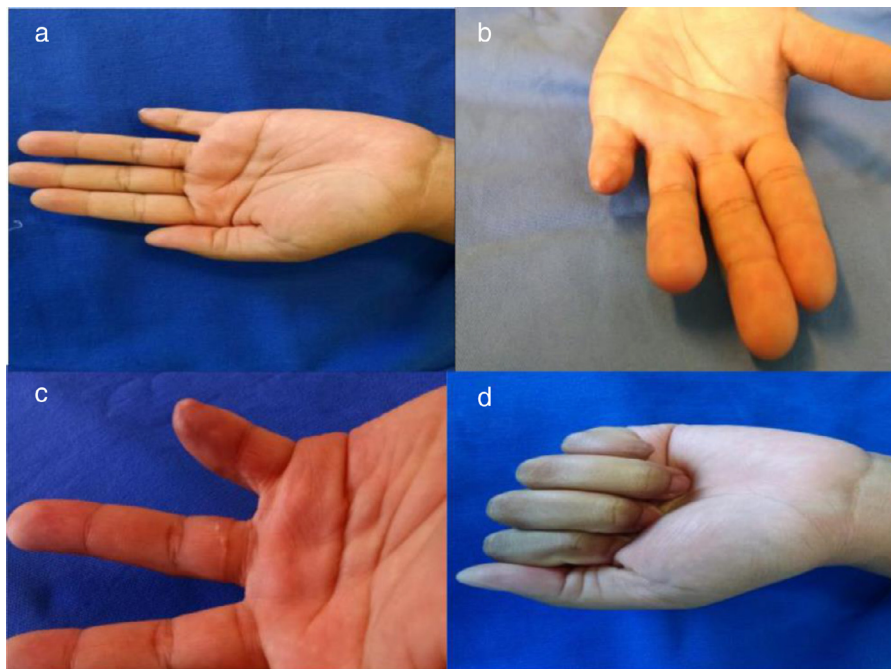


Fig. 4 – 3rd surgical case – female, 22 years, distal interphalangeal amputation of the fifth left finger due to trauma, 20 months postoperatively. Superior view of the affected hand (a). Axial view of the fifth finger (b). Healed surgical wound (c). Finger flexion (d). Source: Surgical technique teaching files by Dr. Tarsila Pagnan Silva dos Santos.

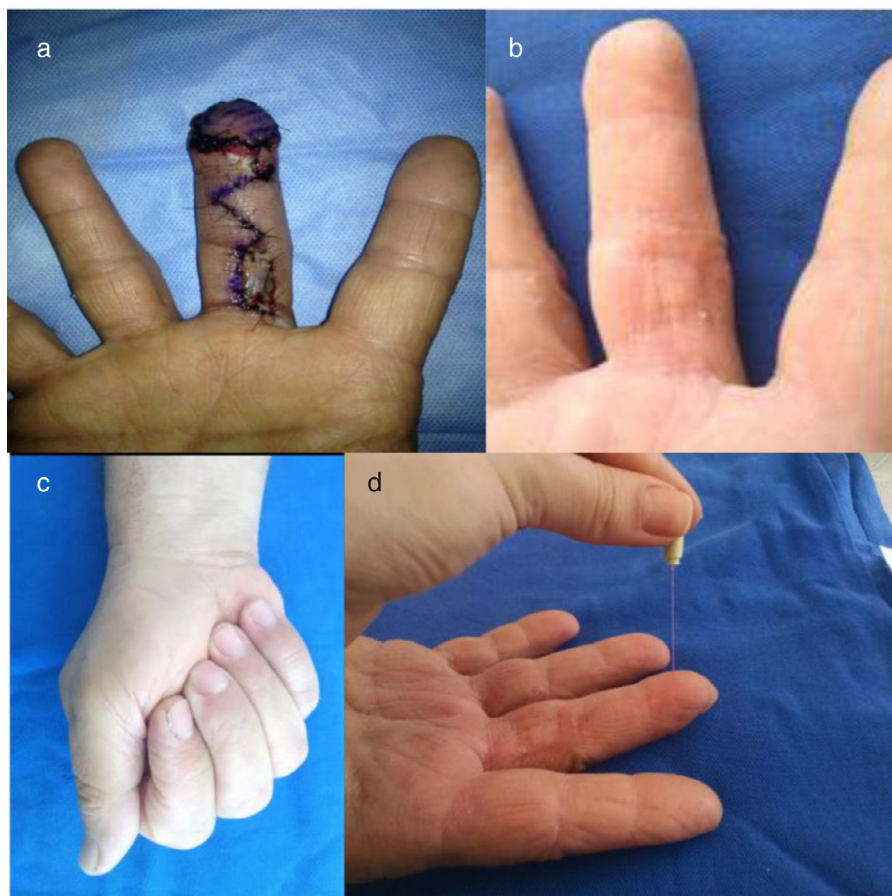


Fig. 5 – 4th surgical case – male, 59 years, traumatic injury of the third right finger. Immediate postoperative period (a). Palmar aspect showing scar tissue on the radial side of the third finger (b). Total flexion of proximal and distal metacarpophalangeal and interphalangeal joints (c). Application of the Semmes-Weinstein test, positive for purple monofilament. 22 months postoperative (d).

Source: Surgical technique teaching files by Dr. Marcelo Tavares de Oliveira - Master and PhD in Hand Surgery - Unifesp.

Regarding the etiology, seven patients suffered injuries from blunt trauma or crushing, and one patient from chemical burns.

As complications, two patients presented a positive Tinel sign at the donor area of the flap, and one reported cold intolerance.

Table 3 presents a complete description of the quantitative variables.

The mean time to return back to work was seven weeks (Table 3).

Three patients (37.5%) presented right-hand and five (62.5%), left-hand involvement ($p=0.317$).

No cases of partial or total necrosis of the surgical flap or retractions or contractures in flexion were observed.

Discussion

Digital pulp lesions are of great importance due to their high prevalence and possible harm to the patient, whether physical, emotional, work-related, or esthetic.

The size of the lesion, the association with amputation, the quality of the donor area, the experience of the surgeon, and the profile of the patient should be taken into account.

Local flaps are preferred due to technical simplicity, and the fact that the receiving area has the same characteristics.^{3-5,12-14}

Regarding gender, this study included six male patients (75%), in line with other studies.^{2,14} As for the side, the left hand was affected in most cases (62.5%). This variable diverges from the results of the study by Huang et al.,⁸ which showed 52.5% of cases on the right limb and 47.5% on the left.

The follow-up time observed in the literature was quite heterogeneous, ranging from six months to nine years.¹⁵ In the present study, the mean follow-up time was 23 months.

Regarding etiology, trauma was the most common cause. Acar et al.¹³ showed 100% of traumatic lesions.

In the present sample, the most affected finger was the third finger (75%), probably due to its greater exposure in relation to the others (Table 2).¹²

The mean flap area was 294.4 mm², similar to the studies found in the literature (Table 3).^{3,13-17}

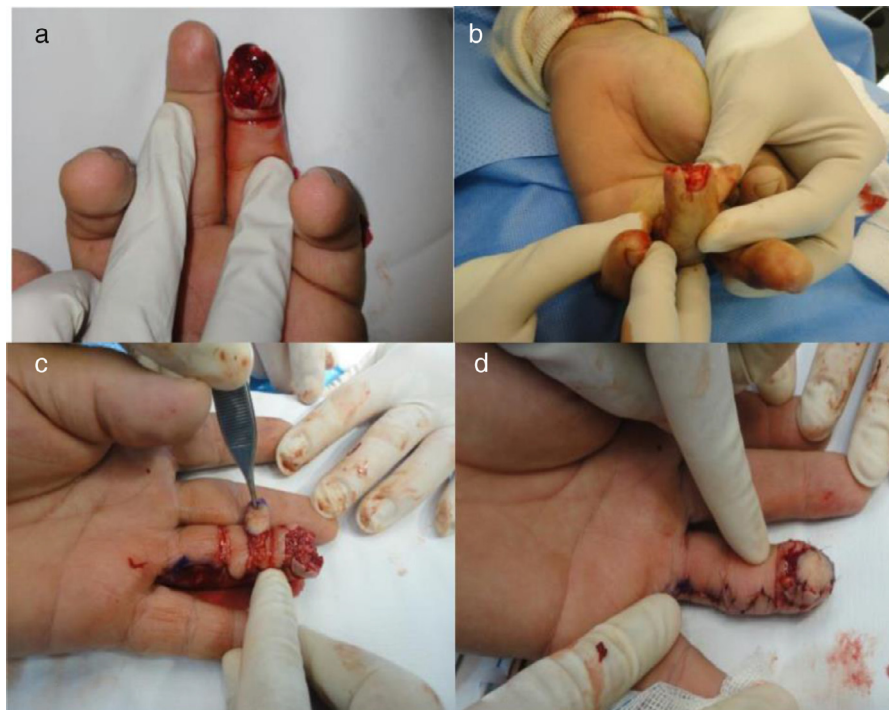


Fig. 6 – 5th surgical case – male, 31 years, traumatic lesion of fourth left finger. Preoperative digital pulp volar lesion (a). Dorsal view of the digital pulp after cleansing and intraoperative debridement (b). Rotation of pedicle flap (c). Immediate postoperative period (d).

Source: Surgical technique teaching files by Dr. Marcelo Tavares de Oliveira – Master and PhD in Hand Surgery – Unifesp.

Table 3 – Full description of the quantitative variables: age; two-points (mm), two-points discrimination test in millimeters; ROM, range of motion; FT (m), follow-up time in months; flap length in mm; flap width in mm; flap area in mm.

Descriptive	Mean	Median	Standard deviation	CV	Q1	Q3	Min	Max	N	CI
Age	32.9	29	13.1	40%	22.8	36.8	22	59	8	9.1
Two-point test (mm)	7.3	7	1.4	19%	6.0	8.0	6	10	8	1.0
ROM	98.9	100	2.9	3%	100.0	100.0	92.3	100	7	2.2
FT (m)	23.0	22.5	6.5	28%	19.5	29.0	12	31	8	4.5
Flap length	19.1	19	1.9	10%	18.0	20.3	16	22	8	1.3
Flap width	15.3	15	1.8	11%	14.8	17.0	12	17	8	1.2
Flap area	294.4	285	60.2	20%	265.5	344.3	192	374	8	41.7
Return to work (w)	7.0	7	1.1	15%	6.0	7.3	6	9	8	0.7

Most patients maintained the range of motion (98.9%). Regmi et al.¹⁷ performed a systematic review and found an mean range of motion of 63° only of the distal interphalangeal joint.

As a disadvantage, the homodigital flap presented decreased sensation when assessed by specific tests. In the Semmes-Weinstein test,¹¹ all patients responded to the purple filament, that indicates decreased protective sensation of the hand. The results were similar in comparison with other authors.^{14,15,18-21} Yazar et al.¹² observed that 91.42% of the patients did not present alteration of sensation (green monofilament) and 8.42% had decreased sensation (purple monofilament).

The mean of the two-point discriminatory test was 7.3 mm. According to statistical data in the literature, the mean

distance in the two-point discrimination test is 6 mm for innervated flaps and 9 mm for non-innervated flaps.^{16,17}

In the present study, the main complications were the persistent Tinel sign in two patients (Acar et al., 9% of neuromas),¹³ and one patient reported cold intolerance.

In the literature, a 24% incidence was observed in the systematic review by Regmi et al.¹⁷ No cases of total or partial necrosis of the flap were observed, similar to the 99% success rate found in the literature. No cases of venous congestion or flexion contracture were observed; in the systematic review performed by Regmi et al.,¹⁷ a 4% rate of these complications was observed.

In the present sample, no patient complained of limitation of daily activities or work. On average, patients returned

back to work after seven weeks, similar to that found by other authors.^{13,17}

Conclusion

The homodigital flap surgical technique presented satisfactory esthetic and functional results regarding the viability, mobility, and esthetics of the finger, with sufficient sensation to prevent lesions.

Conflicts of interest

The authors declare no conflicts of interest.

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